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Rodriguez

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(54) **REMOTELY ACTIVATED BRIDGE DEVICE FOR USE WITH A HOME NETWORK AND METHODS FOR PROGRAMMING AND USING THE SAME**

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(58) **Field of Classification Search** 455/41.1, 455/41.2, 418, 41.3, 88, 66.1, 344, 343.1, 455/343.5; 340/825.69, 5.71
See application file for complete search history.

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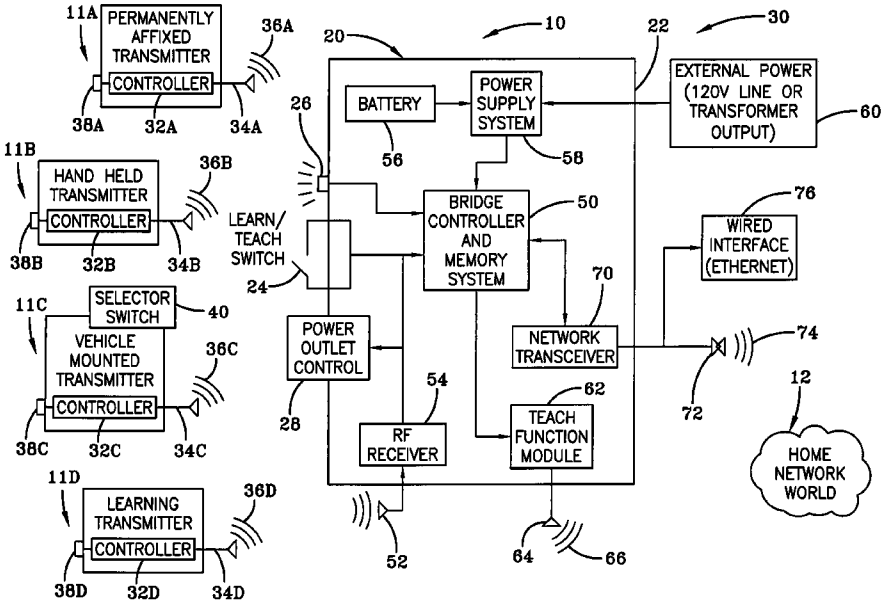
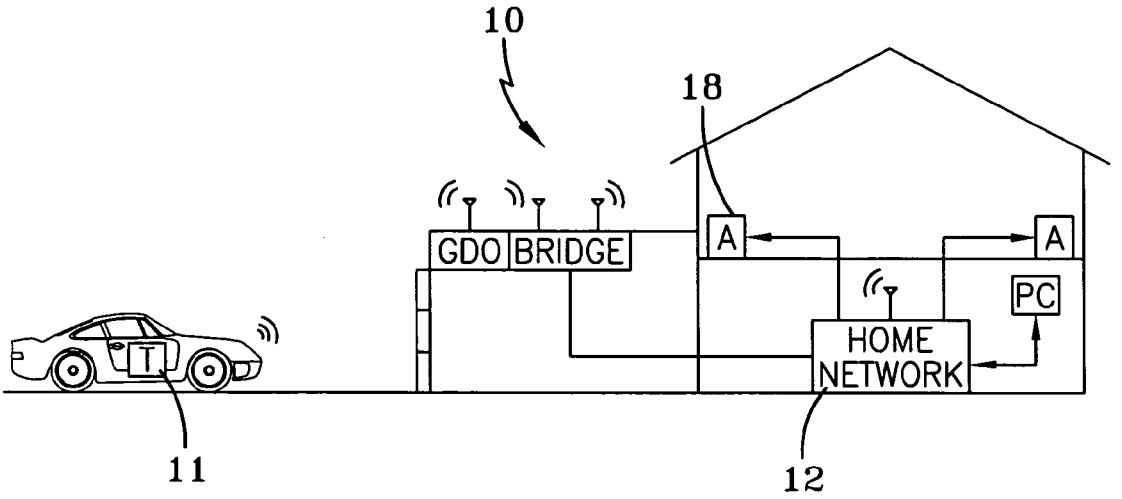
(57) **ABSTRACT**

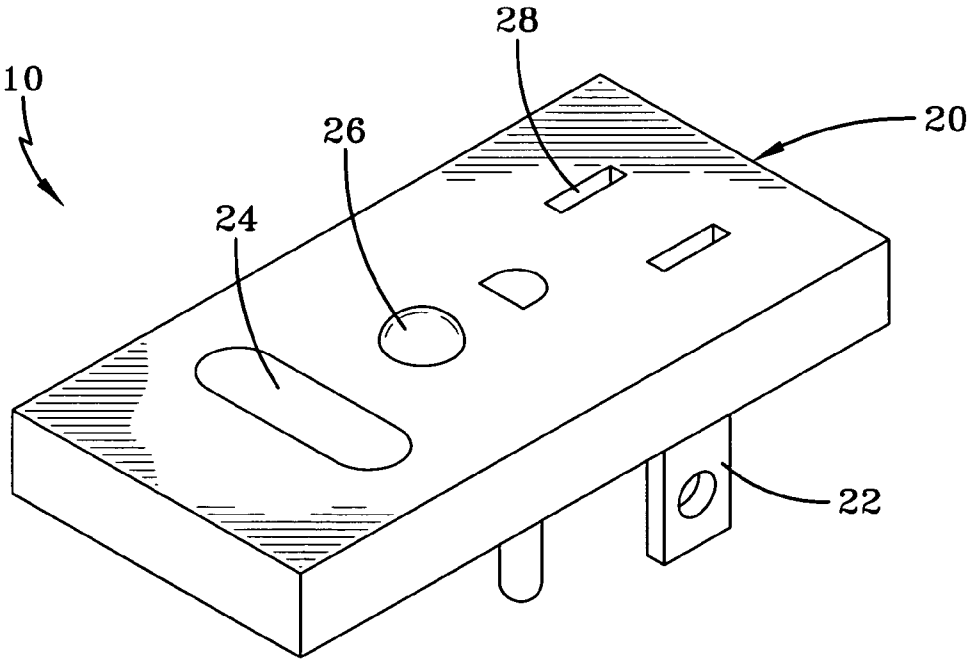
A bridge device linking transmitters to a home network includes a transmitter signal receiver adapted to receive transmitter signals in a transmitter format from at least one transmitter and a network signal transceiver adapted to transmit and receive network signals in a network format to and from a home network. A bridge controller is connected to the transmitter signal receiver and the network signal transceiver for the purpose of converting the signals between the formats. The bridge device is able to learn various transmitter type for conversion to a learned home network standard. A master controller may be used to assign specific transmitter button actuations to control specific appliance functions.

28 Claims, 6 Drawing Sheets





FIG–1



FIG–2

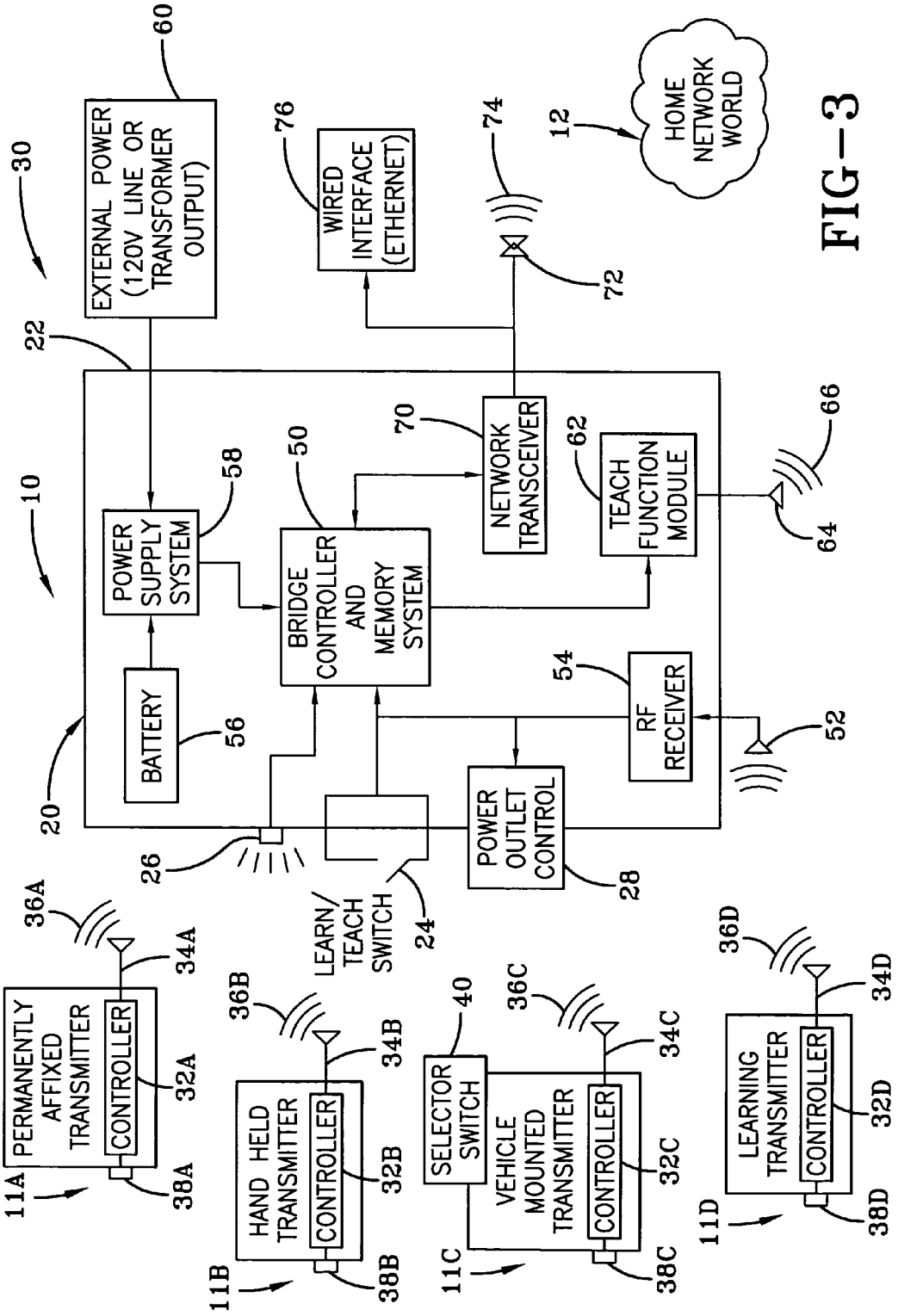

30
EXTERNAL POWER (120V LINE OR TRANSFORMER OUTPUT)
60
WIRED INTERFACE (ETHERNET)
76
74
12
HOME NETWORK WORLD
22
72
10
POWER SUPPLY SYSTEM
58
BRIDGE CONTROLLER AND MEMORY SYSTEM
50
NETWORK TRANSCEIVER
70
TEACH FUNCTION MODULE
62
66
64
BATTERY
56
RF RECEIVER
54
52
20
26
LEARN/ TEACH SWITCH
24
POWER OUTLET CONTROL
28
36A
34A
PERMANENTLY AFFIXED TRANSMITTER
CONTROLLER
32A
11A
38A
36B
34B
HAND HELD TRANSMITTER
CONTROLLER
32B
11B
38B
40
SELECTOR SWITCH
36C
34C
VEHICLE MOUNTED TRANSMITTER
CONTROLLER
32C
11C
38C
36D
34D
LEARNING TRANSMITTER
CONTROLLER
32D
11D
38D

FIG-3

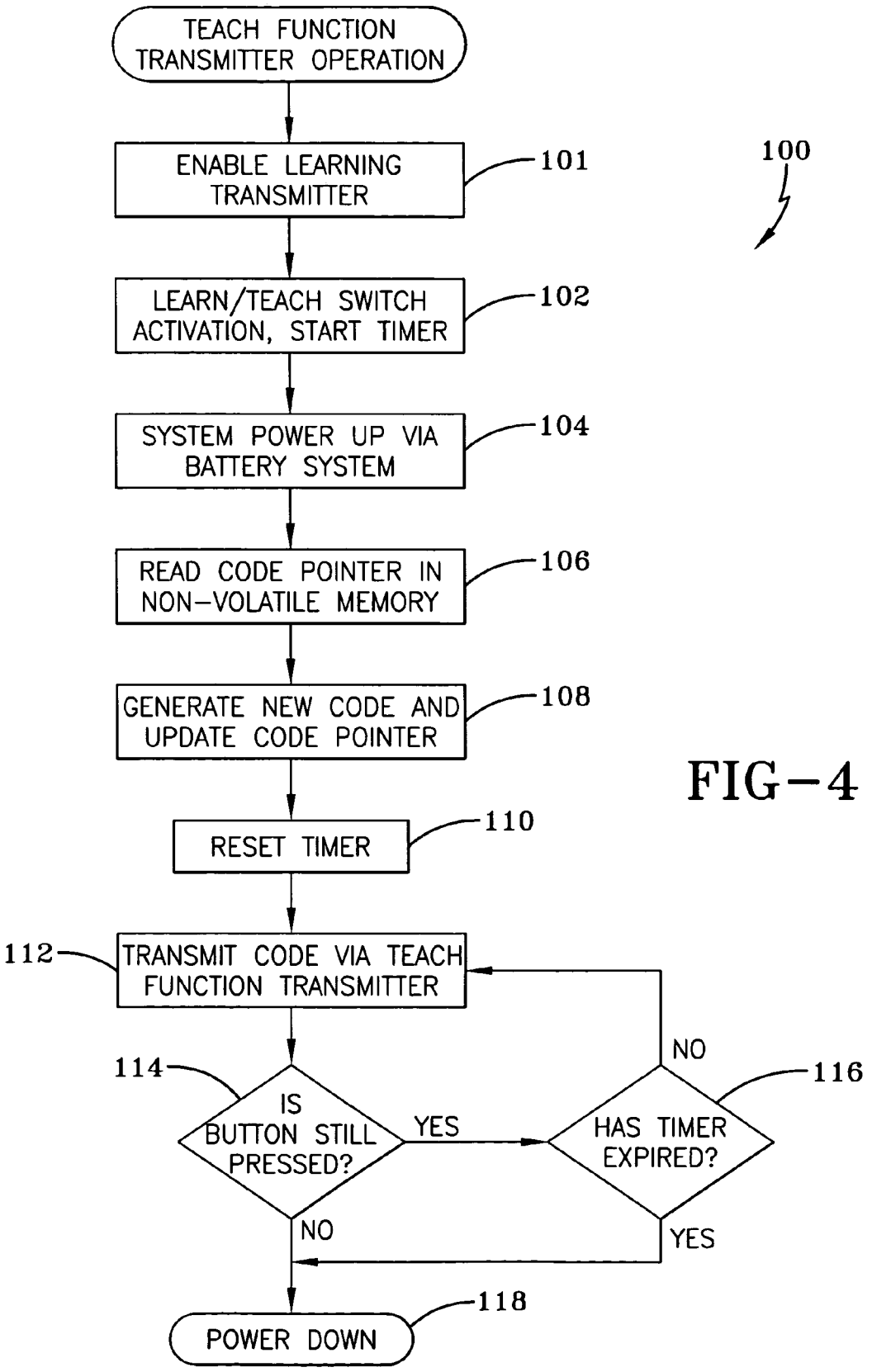

TEACH FUNCTION TRANSMITTER OPERATION
ENABLE LEARNING TRANSMITTER
101
100
LEARN/TEACH SWITCH ACTIVATION, START TIMER
102
SYSTEM POWER UP VIA BATTERY SYSTEM
104
READ CODE POINTER IN NON-VOLATILE MEMORY
106
GENERATE NEW CODE AND UPDATE CODE POINTER
108
RESET TIMER
110
112
TRANSMIT CODE VIA TEACH FUNCTION TRANSMITTER
114
IS BUTTON STILL PRESSED?
YES
NO
HAS TIMER EXPIRED?
116
NO
YES
POWER DOWN
118

FIG-4

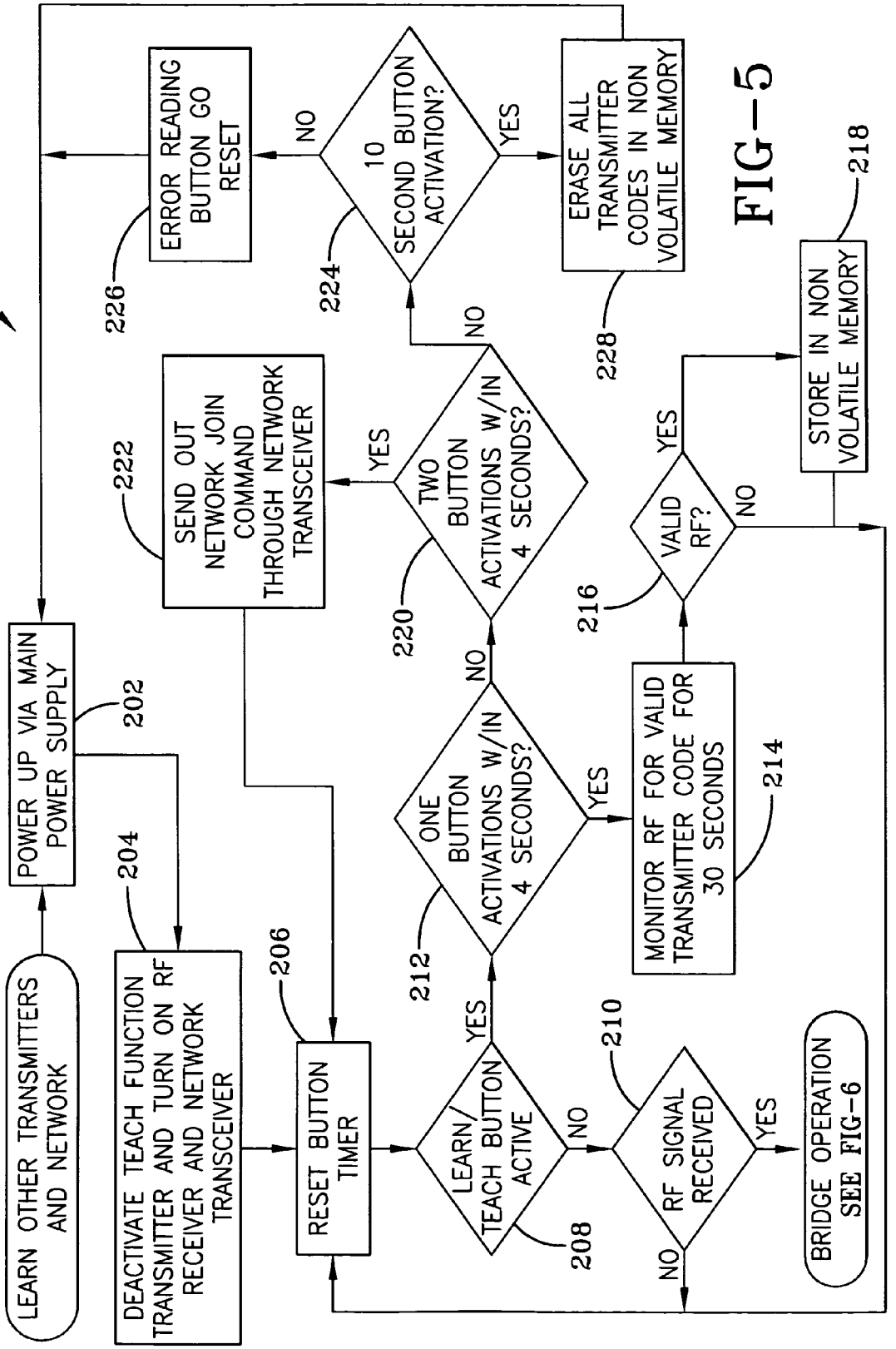

200
POWER UP VIA MAIN POWER SUPPLY
202
LEARN OTHER TRANSMITTERS AND NETWORK
DEACTIVATE TEACH FUNCTION TRANSMITTER AND TURN ON RF RECEIVER AND NETWORK TRANSCEIVER
204
RESET BUTTON TIMER
206
LEARN/ TEACH BUTTON ACTIVE
208
YES
NO
RF SIGNAL RECEIVED
210
YES
NO
BRIDGE OPERATION SEE FIG-6
ONE BUTTON ACTIVATIONS W/IN 4 SECONDS?
212
YES
NO
MONITOR RF FOR VALID TRANSMITTER CODE FOR 30 SECONDS
214
VALID RF?
216
YES
NO
STORE IN NON VOLATILE MEMORY
218
TWO BUTTON ACTIVATIONS W/IN 4 SECONDS?
220
YES
NO
SEND OUT NETWORK JOIN COMMAND THROUGH NETWORK TRANSCEIVER
222
10 SECOND BUTTON ACTIVATION?
224
YES
NO
ERASE ALL TRANSMITTER CODES IN NON VOLATILE MEMORY
228
ERROR READING BUTTON GO RESET
226

FIG-5

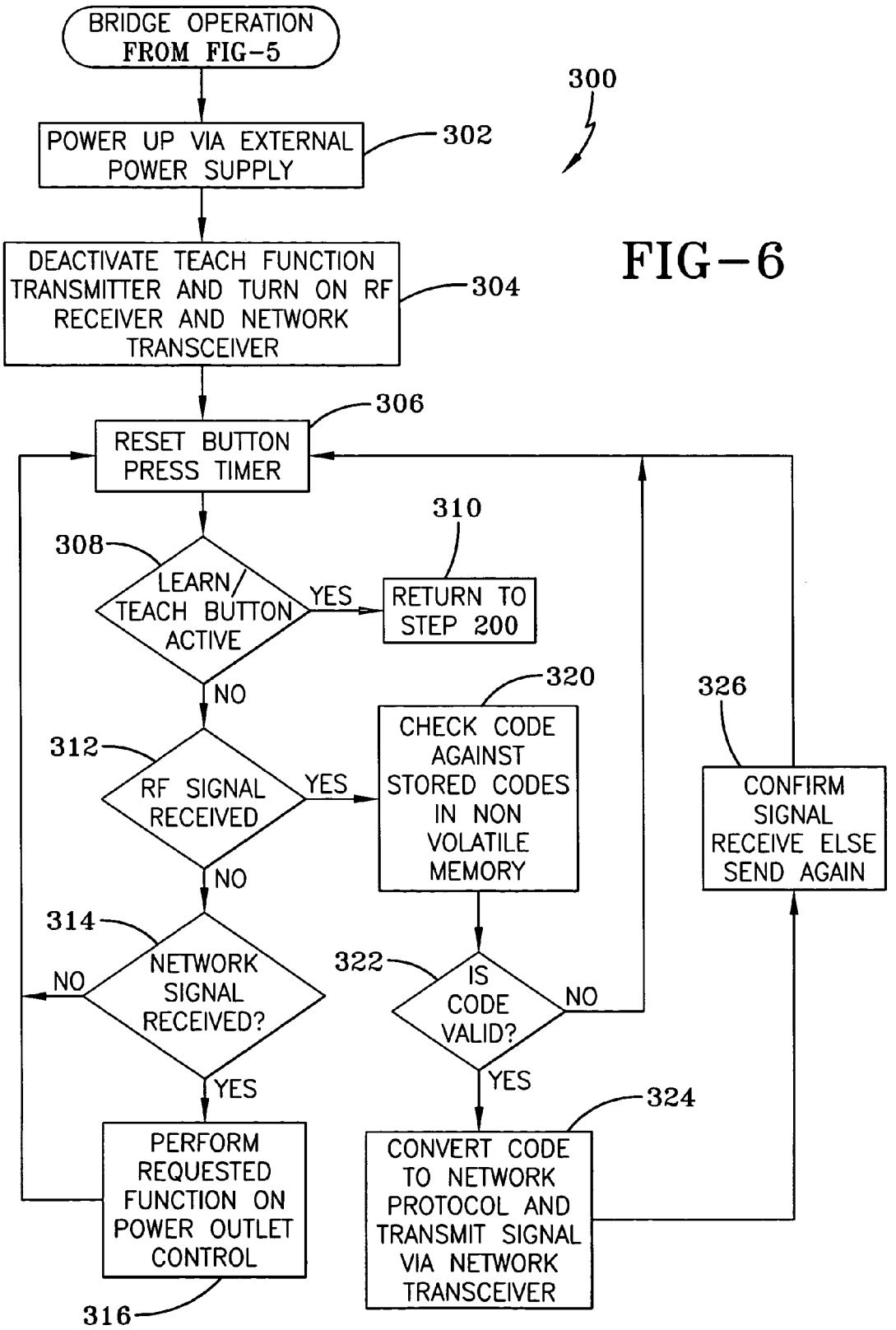

BRIDGE OPERATION FROM FIG-5
300
POWER UP VIA EXTERNAL POWER SUPPLY
302
DEACTIVATE TEACH FUNCTION TRANSMITTER AND TURN ON RF RECEIVER AND NETWORK TRANSCEIVER
304
RESET BUTTON PRESS TIMER
306
LEARN/ TEACH BUTTON ACTIVE
308
YES
RETURN TO STEP 200
310
NO
RF SIGNAL RECEIVED
312
YES
CHECK CODE AGAINST STORED CODES IN NON VOLATILE MEMORY
320
NO
NETWORK SIGNAL RECEIVED?
314
NO
YES
IS CODE VALID?
322
NO
YES
CONFIRM SIGNAL RECEIVE ELSE SEND AGAIN
326
PERFORM REQUESTED FUNCTION ON POWER OUTLET CONTROL
316
CONVERT CODE TO NETWORK PROTOCOL AND TRANSMIT SIGNAL VIA NETWORK TRANSCEIVER
324

FIG-6

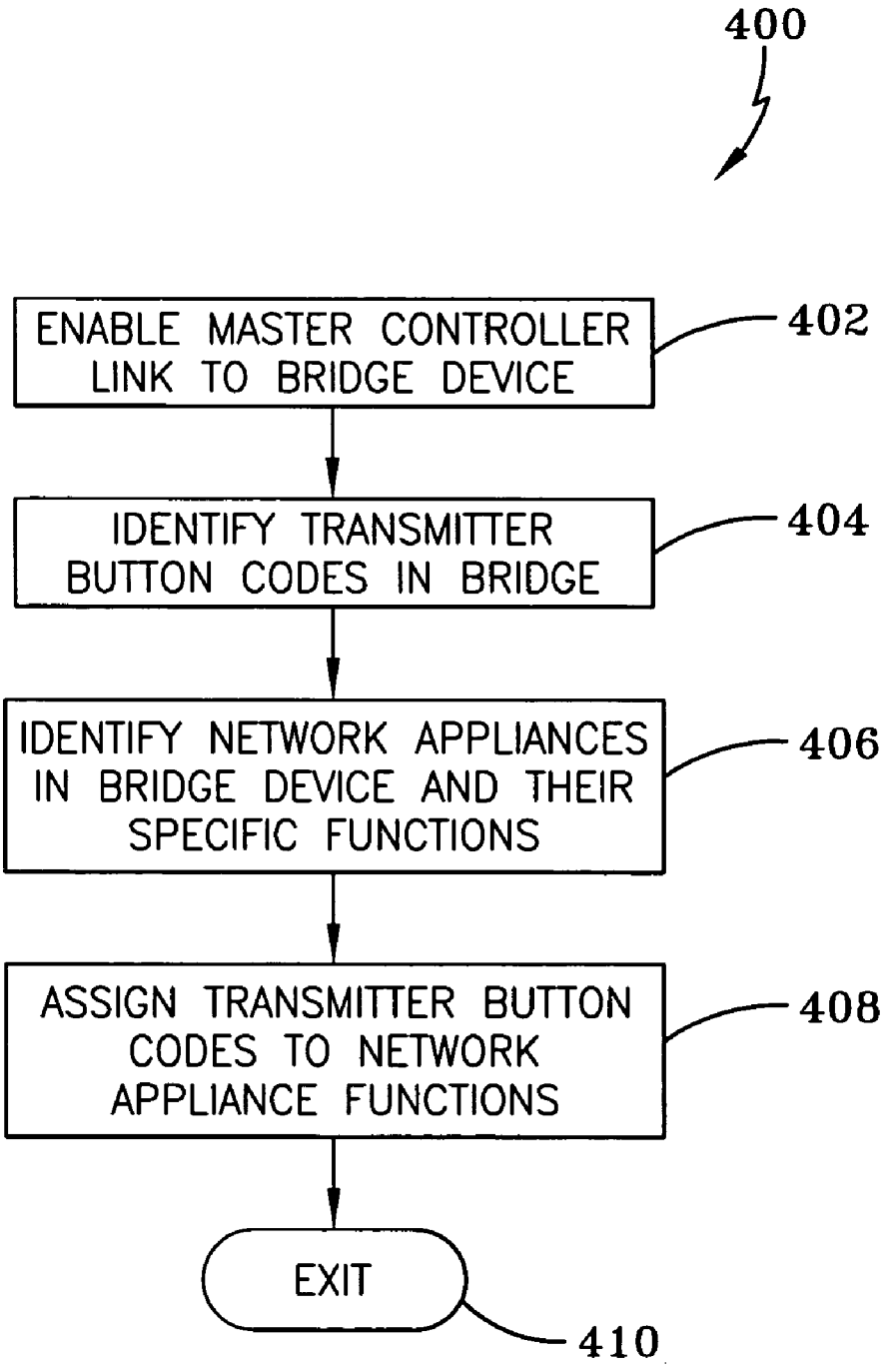

400
ENABLE MASTER CONTROLLER LINK TO BRIDGE DEVICE
402
IDENTIFY TRANSMITTER BUTTON CODES IN BRIDGE
404
IDENTIFY NETWORK APPLIANCES IN BRIDGE DEVICE AND THEIR SPECIFIC FUNCTIONS
406
ASSIGN TRANSMITTER BUTTON CODES TO NETWORK APPLIANCE FUNCTIONS
408
EXIT
410

FIG-7

REMOTELY ACTIVATED BRIDGE DEVICE FOR USE WITH A HOME NETWORK AND METHODS FOR PROGRAMMING AND USING THE SAME

TECHNICAL FIELD

The present invention is generally related to a home network. In particular, the present invention is related to a home network that allows for communications between non-network transmitters and home appliances which may or may not be controlled by a personal computer. Specifically, the present invention is related to a bridge device that allows for transfer of signals between various electronic transmitters not normally part of a home network, such as those used for garage door openers, and a home network.

BACKGROUND ART

The home networking field has been increasing in popularity the last few years. The "digital home," as referred to by industry insiders, will supposedly enable consumers to network and interface various types of appliances and devices throughout the home. For example, it is believed that the network will allow linking of such home appliances as alarm clocks, stereo equipment, televisions and kitchen appliances. For example, after an alarm clock has sounded and the network detects activity in the bathroom in the morning, then the network can alert the coffee maker in the kitchen to begin preparation of a pot of coffee. Or, the bathroom scale can be continually monitored and provide input data upon each weighing to exercise software on a home computer linked to home exercise equipment.

Manufacturers from a wide variety of industries have been developing "networked" products to meet this emerging market. Due to lack of industry standards, manufacturers have engaged in developing their own proprietary network protocols and hardware in order to connect devices. As a response to the network incompatibility issue, some industry groups have been formed in order to create "standards" so that manufacturers following these standards are able to create compatible devices adhering to a specific protocol in software and hardware.

Groups such as WI-FI, which adhere to the 802.11×IEEE standards, are producing products today to allow fast connection between computer and multi-media systems. This particular standard is designed for transferring a large amount of data across a wireless network. Other groups such as the "Powerline" group have developed fast data transfer networks using the existing home electrical wiring. Yet other groups have formed standards such as HomeRF.

When fast data rates are required, the aforementioned standards work very well. However, in cases where simple control signals such as "on\off" and status are required, a fast data network becomes "overkill" for these simple applications. Manufacturers requiring a simpler type of network for control applications have developed standards such as "Zigbee" and "Z-wave" in an effort to keep their overall systems price competitive. These "control" networks add yet another level of complexity to the home integrator whose job is to make all of these systems work together seamlessly. In addition, different standards are being developed which presumably link the internet and cell phone communications systems with the home network. It is also believed that the home network may be extended into devices maintained in the garage or barriers that are accessible by the operator controlling the barrier, but the communication standards

utilized by the garage door operator and the home network are not at all compatible. Since the goal of the home network is to connect all devices together and to offer consumers easy-to-use interfaces, it is necessary to develop interfaces capable of "bridging" devices utilizing incompatible communication protocols.

One example of a home network system is disclosed in U.S. Pat. No. 6,481,013 to Dinwiddie, et al. This patent discloses an apparatus for distributing radio frequency (RF) modulated broadcast television signals from a broadcast signal source to networked appliances connected to the source through a plurality of single conductor coaxial cables, simultaneously with distributing un-modulated digital signals and RF modulated video signals exchanged between the networked appliances over the same network coaxial cables. The apparatus provides bi-directional signal transmission over a single conductor coaxial cable and a network capable of conducting simultaneous bi-directional signal transmission of un-modulated digital signals, and radio frequency (RF) modulated signals over a single conductor coaxial cable. The apparatus also provides a network capable of providing bi-directional signal transmission of broadband, baseband and infrared signals over a single conductor coaxial cable. And the apparatus provides bi-directional transmission of high bandwidth broadband signals over a low bandwidth single conductor coaxial cable.

Another example of an interface device is provided by U.S. Pat. No. 6,155,160 to Hochbrueckner which discloses an electronic control for a grill, providing enhanced functionality and safety features. One of the features is a hydrocarbon detector system that provides an intermittently operated electro-optic device emitting photons at a wavelength which selectively interacts with hydrocarbon as compared to air, associated with a detector for detecting the selective interaction and an alarm monitor for detecting an alarm state. Another feature is a food temperature sensor that is employed to proportionately control combustible fuel flow rate, and thereby control a food temperature profile. Still another feature is a communications network interface is provided to allow remote control and monitoring. In one embodiment, the electronic systems include a networking device, for example a TCP/IP based communications interface, for communicating with other devices in the environment, or remotely. For example, the microprocessor may include a so-called embedded "web server" to communicate sensed conditions and to respond to received commands or requests for information. Of course, the controller need not itself implement these protocols, and may communicate with a translation or bridge device using another protocol. Therefore, the device may be integrated with other domestic electronics systems and communicate therewith. Various known physical link layers may be employed, such as 10 Base T, 10 Base 2, phone-line networking, AC power line networking, RF communications (e.g., 24 MHz, 49 MHz, 900 MHz or 2.4 GHz), infrared communications (e.g., IRdA), acoustic communications, or the like. In order to reduce power consumption, a wireless communication system preferably provides at least two modes of operation, an active mode wherein the communications latencies are short, and a low power mode wherein the communications are shut down or operated with long latencies. The system may switch between modes automatically or on external command.

Although the aforementioned devices are effective in their stated purpose, they do not address the incompatibility of different non-network components. In other words, there is a need in the art for a device that facilitates communication

between remote transmitters or transmitters that control the operation of the movable barrier, or the like, with the appliances controlled by a home network.

SUMMARY OF THE INVENTION

Therefore, there is a need in the art for remotely activated bridge device for use with a home network and methods for programming and using the same

Another object of the present invention, which shall become apparent as the detailed description proceeds, is achieved by a bridge device linking transmitters to a home network, comprising: a transmitter signal receiver adapted to receive transmitter signals in a transmitter format from at least one transmitter; a network signal transceiver adapted to transmit and receive network signals in a network format to and from a network; a controller connected to the transmitter signal receiver and the network signal transceiver, the controller converting the signals between the formats.

A further object of the invention is to provide a method for enabling a home network bridge device, including providing a controller linked to a transmitter signal receiver, a network signal transceiver, and a power supply system; detecting a type of power source connected to the power supply system; and selectively enabling a teach function module connected to the controller depending upon the type of power source detected.

Yet a further object of the invention is to provide a method for operating appliances connected to a home network system, including providing a bridge controller linked to a transmitter signal receiver and a network signal transceiver; receiving a transmitter signal in a transmitter format; converting the transmitter signal into a network signal in a network mode format; and emitting the network signal from the network signal transceiver for receipt by the home network system which controls operation of at least one appliance.

These and other objects of the present invention, as well as the advantages thereof over existing prior art forms, which will become apparent from the description to follow, are accomplished by the improvements hereinafter described and claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

For a complete understanding of the objects, techniques and structure of the invention, reference should be made to the following detailed description and accompanying drawings, wherein:

FIG. **1** is a schematic diagram of a home network employing a bridge device in accordance with the concepts of the present invention;

FIG. **2** is a perspective view of an exemplary bridge device made in accordance with the concepts of the present invention;

FIG. **3** is a schematic diagram of the exemplary bridge device employed in conjunction with transmitters utilized to move a barrier and initiate commands implemented by the home network;

FIG. **4** is an operational flow chart illustrating the steps implemented in teaching a bridge device to one type of transmitter;

FIG. **5** is an operational flow chart illustrating the steps implemented to learn other transmitters and a home network to the bridge device;

FIG. **6** is an operational flow chart illustrating the operational steps of the bridge device so as to allow communication between transmitters or the like and the home network; and

FIG. **7** is an operational flow chart illustrating the operational steps for assigning functions in the home network to a transmitter.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring now to the drawings and in particular to FIG. **1** it can be seen that a bridge device implemented within a home network scheme is designated generally by the numeral **10**. Generally, the bridge device **10** functions as an interface between a transmitter **11** employed in the opening and closing of movable barriers such as a garage door, gate, or other related device, and a home network designated generally by the numeral **12**. It will be appreciated that the home network **12** refers to any appliance type network maintained in a building, warehouse or similar structure. The bridge device **10**, as will become apparent as the description proceeds, receives signals and communicates with at least one transmitter **11**, designated as a T in the drawing, which may be carried by an automobile or other moving object. The transmitter is typically utilized with a garage door operator designated as "GDO" in FIG. **1**, but could be some other type of wired or wireless transmitter. In other words, actuation of a button on the transmitter **11** generates a code that is received by both the garage door operator to control movement of the door and related features, and by the bridge device which passes along the code to the home network. Indeed, the transmitters may have more than one button wherein each button is assigned a specific function in the home network. And the bridge device may be configured to process transmitter codes solely for the operator or solely for the home network, or for both the operator and the home network. The transmitter may employ fixed or rolling codes in order to provide security features related to the opening and closing of the garage door and the network. Any one of the transmitters may be a "hands-free" transmitter which initiates a preset command based upon the proximity or direction of travel of the transmitter with respect to the garage door operator and/or the bridge device **10**.

The home network **12** is connected either via wires or by wireless communication devices to appliances **18** such as air conditioners, furnaces, lights contained throughout the facility, entertainment systems, refrigerators, scales, personal computers, plumbing fixtures and the like. And the home network **12** may be linked to other home networks contained within a community or within a facility. Control of the home network may be implemented by a personal computer—designated as PC in the drawing—or a personal digital assistant, either of which may be referred to as a "master controller."

Referring now to FIG. **2**, it can be seen that the bridge device **10** includes a housing designated generally by the numeral **20**. The housing provides a standard power outlet plug **22** that fits in any receptacle. The plug may receive power directly from the residential power source such as 120V AC or it may receive power from any transformed power source that is grounded and complies with the appropriate safety standards. The housing **20** provides at least one learn switch **24** that is used to learn various components within the home network and the transmitter. The housing **20** also provides a status light **26** which may facilitate the

learning of the bridge device with components within the home network and the transmitters. The housing **20** may also provide a power receptacle **28** which allows for a switched component to be associated with the bridge device.

Referring now to FIG. **3**, it can be seen that an interface system is designated generally by the numeral **30**. The interface system includes the bridge device **10** and at least one transmitter designated generally by the numeral **11**. Also included within the system is the home network designated generally by the numeral **12**.

Various types of transmitters may be employed in the interface system, although it is believed that in the preferred embodiment the transmitters are associated with a garage door operator that moves a barrier between predetermined limit positions. The transmitters are designated generally by the numeral **11**, wherein each different type of transmitter is provided with a different alphabetic suffix. Likewise, each component with a particular transmitter is provided with corresponding alphabetic suffixes. Accordingly, a permanently affixed transmitter is designated generally by the numeral **11**A and is attached to a wall or other surface and is commonly referred to in the art as a wall station or sometimes as a keyless entry device. The transmitter **11**A includes a controller **32**A which provides the necessary hardware, software and memory needed to communicate with the garage door operator and the bridge device **10**. The controller **32**A is connected to an antenna **34**A for the purpose of transmitting and receiving a radio frequency signal designed generally by the numeral **36**A. These signals may be generated upon actuation of a button **38**A that is connected to the controller **32**A. Although it is preferred that a radio frequency signal be employed it will be appreciated that other signals such as an infrared signal may be employed and, it will be appreciated that the permanently affixed transmitter may transmit or receive signals via a wired connection.

A handheld transmitter **11**B may also be employed in the present invention and it includes a controller **32**B that generates signals that are transmitted by an antenna **34**B upon actuation of a button **38**B. The controller **32**B includes the necessary hardware, software and memory for communicating with the bridge device. The handheld transmitter may be in the form of a "hands-free" transmitter wherein the signals received by the bridge device and garage door operator system may be initiated when the automobile or like movable object carrying the transmitter moves within a predetermined distance of the bridge device. For example, if the handheld transmitter is a hands-free device and moves a distance of 300 feet to 100 feet from the operator it will be presumed that the device is moving toward the garage and causes the operator to move the barrier from a closed position to an open position. Other related movements of the transmitter may also effect the operation of the garage door operator and/or the components connected to the home network as programmed by the end-user.

Another type of transmitter may be a vehicle mounted transmitter designated generally by the numeral **11**C. The transmitter **11**C is provided with a controller **32**C that has the necessary hardware, software and memory for implementing the concepts of the present invention. The controller **32**C is connected to an antenna **34**C for emitting a radio frequency signal **36**C as deemed appropriate. A button **38**C is connected to the controller **32**C for emitting an appropriate signal when actuated to control operation of the garage door and bridge device. The vehicle mounted transmitter **11**C includes a learning function selector switch designated generally by the numeral **40**. The switch **40** allows the user to set the controller **32**C to the garage door operator's manufacturer's code. In other words, a plurality of manufacturer's codes are pre-stored in the controller **32**C and selected by positioning of the switch as needed. This allows the vehicle mounted transmitter to specifically communicate with both the garage door opener and the bridge device. Accordingly, the bridge device is compatible with virtually all types of transmitters used with movable barriers.

Still another type of transmitter is a learning transmitter designated generally by the numeral **11**D. The transmitter **11**D includes a controller **32**D that has the necessary hardware, software and memory for operation in the system **30**. The controller **32**D is also operatively connected to an antenna **34**D which emits an RF signal **36**D. And the controller generates an RF signal when actuated. In some instances though, actuation of the button **38**D places the transmitter in a learn mode so that an RF signal can be received, learned and stored by the controller. Such a learning function is embodied in the HomeLink™ system provided by Johnson Controls, Inc. and which is incorporated in some automobiles. Such a system allows for the user to program the HomeLink™ button contained within their automobile to control and operate the garage door opener. This eliminates the need for keeping a handheld remote transmitter within the automobile. It will be appreciated that other types of transmitter devices may be usable with the bridge device. In other words, any transmitting device that does not directly communicate with appliances in the home network, may be associated with the bridge device which can receive signals generated by the transmitter for conversion to the necessary format and convey the appropriate instructions to the network world **12**.

The bridge device **10** includes the plug **22** that is mateable with any standard electrical outlet providing residential or facility power. And the device **10** also includes the learn/teach switch **24**, the status light **26** and an appropriate power outlet control **28**.

The bridge device **10** also includes a bridge controller and memory system designated generally by the numeral **50**. The controller **50** is connected to all of the components mentioned above such as the plug **22**, the switch **24**, the status light **26** and the power receptacle **28**. The controller and memory system **50** includes the necessary hardware, software and memory to facilitate communications between the bridge's internal components and to facilitate communications between the transmitters **11** and the network world **12**. The bridge includes an antenna **52** that receives radio frequency or other types of wireless signals generated by the transmitters for transfer to an appropriate receiver **54**. The receiver **54** is connected to the controller and receives at least signals **36**A-D. The signals received by the receiver **54** are submitted to the controller and memory system **50** for validation and confirmation.

Contained within the housing **20** is an internal battery **56** which is preferably a long-life battery of about 3 volts. Of course, other battery voltages could be used if appropriate. The battery **56** is connected to a power supply control system **58** which is directly linked to the controller **50**. Also connected to the power supply system is the plug **22** which receives external AC/DC power **60** which may either be 120V line or transformer output regulated power. The controller and memory system **50** defaults to the external power source **60** if connected. It will be appreciated as the detailed description proceeds that the type of power employed by the bridge device dictates the bridge's mode of operation which is employed for the learning of the various devices to the bridge and for the general operation of the bridge.

A teach function module **62** is connected to the controller **50** and undertakes various functions upon actuation of the learn/teach switch **24** and depending upon the power supply utilized by the controller **50**. As will become apparent as the detailed description proceeds, actuation of the learn teach switch causes the controller and the teach function module to generate a code that is emitted by an antenna **64** preferably in the form of a radio frequency code **66**. This code **66** may be received by the learning transmitter **11**D as required by the end use.

A network transceiver, designated generally by the numeral **70**, is connected to the controller and memory system **50** and functions to communicate directly with the network world **12** by generating a network radio frequency signal **74** that is emitted by an antenna **72**. Alternatively, a wired interface **76** may be connected to the network transceiver **70** to allow for direct communications to the network world **12**.

The bridge device has three modes of operation. The first mode of operation is active whenever the external power is not connected and as such the device is powered by the battery **56**. The second mode of operation is active as soon as the device is plugged into the external source of power **60**. And the third mode of operation is activated whenever power is received from the external power source and a valid code is received from a non-network transmitter or device. In other words, the third mode is the normal operation mode wherein the bridge device receives signals from a transmitter appropriately programmed to communicate with the bridge device and converts signals received from these transmitters into a format that is acceptable by the network. This mode also allows receipt of signals from the network **12**.

Referring now to FIG. **4**, an operational flow chart illustrating the steps implemented in the first mode of operation is designated generally by the numeral **100**. The bridge device **10** is preferably shipped from a factory without any transmitter codes programmed into the controller's memory. In other words, the bridge device is a "clean slate" and requires the programming of transmitters in order to function with the home network. This particular mode is specifically utilized to teach a code generated by the teach function module **62** to the learning transmitter **11**D. In other words, for this mode, the end-user teaches a factory preset code from the bridge to the learning transmitter. In order to implement this operation, the user must place an unplugged—no external power supply present—bridge device in close proximity to the transmitter unit **11**D.

The process is initiated at step **101** when the user places the transmitter **11**D in its' learn state by actuating the button **38**D or with other steps indicated in the user manual of the learning transmitter. Next, at step **102**, the user activates the learn/teach switch **24** provided by the bridge device **10** which starts a timer. At this time, the controller **50** is powered at step **104** via the internal battery **56**. At step **106**, the controller **50** reads a code pointer provided in the controller's non-volatile memory. At step **108**, the controller generates a new code and updates the code pointer. At step **110**, the timer, which was started upon actuation of the switch at step **102**, is reset. In the preferred embodiment, the timer has a predetermined time period of 40 seconds. Next, at step **112** the teach function module **62** transmits the code generated in step **108** for receipt by the learning transmitter **11**D. At step **114** it is determined whether the learn/teach button is still being pressed and the controller investigates as to whether the timer has expired or not. If it has, then the process proceeds to step **118** and the bridge is powered down. However, if the timer has not expired at step **116** the process returns to step **112**. In any event, the code generated by the controller **50** is transmitted by the teach function module and is received and stored by the learning transmitter **11**D. Subsequent activations of the learning transmitter result in the transmission of the original code generated by the bridge device. Accordingly, the bridge device **10** now automatically recognizes any transmissions generated by the learning transmitter **11**D. It will be appreciated that the learning transmitter may employ a rolling or fixed code if required.

Referring now to FIG. **5**, a second mode of operation for the purpose of learning other types of transmitters (**11**A, **11**B and **11**C) and the network (**12**) to the bridge device is designated generally by the numeral **200**. In this mode, the bridge device **10** is connected to the external supply **60** at step **202**. Following this, at step **204**, the controller **50** deactivates the teach function module and turns on the RF receiver **54** and the network transceiver **72**. Next, at step **206**, a reset button timer is actuated. Following this, the controller awaits actuation of the learn/teach button **24**. If the button is not activated at step **208**, then the process continues on to step **210** to await receipt of a radio frequency signal. If no signal is received within the timer period, then the process returns to step **206** and step **208** is repeated accordingly. If, however, at step **210** a radio frequency signal is received, then the process continues for the bridge operation mode which is designated generally by the numeral **300** and shown in FIG. **6**.

Returning now to step **208**, if the learn/teach button **24** is activated, then the controller **50** determines whether the button **24** has been actuated once or more than once. If the button has only been actuated once, preferably within a time period of four seconds, then at step **214** the receiver **54** monitors for a valid transmitter code for the next 30 seconds. Of course other durations could be employed for the 4 and 30 second periods of time. In any event, at step **216**, the controller determines whether the radio frequency signal received from any of the transmitters **11** is valid or not. If the signal is invalid, then the process automatically returns to step **206**. If the radio frequency signal is valid, then the radio frequency code is stored in the controller's non-volatile memory at step **218** and the process is then returned to step **206**. Accordingly, steps **212**-**218** are employed for learning the transmitters **11**A-C to the bridge device.

Returning to step **212**, if there is more than one button activation within the predetermined period of time of four seconds, then the process proceeds to step **220** to determine whether there have been two button activations within four seconds. If this is the case, then the process continues to step **222** and the network transceiver **70** generates a network join command at step **222**. This signal is received by the network world **12** and allows for communication of the bridge device to join with the network world **12** and, in turn, any of the transmitters programmed to the bridge device. Upon completion of step **222**, the process returns to step **206**.

If there is ever a need to delete all of the codes maintained by the bridge device, then the process at step **220** allows for this occurrence. In particular, if there is more than two button actuations within four seconds, then the process continues to step **224** to determine if the teach/learn switch is held in for a predetermined period of time such as 10 seconds. If for some reason the button is released before the 10 second time period then the process continues to step **226** and the process is reset at step **228** and continues to step **202**. If, however, it is determined that the teach/learn button **24** is held for at least 10 seconds at step **224**, then at step **228** the

controller **50** in the bridge device erases all stored transmitter codes and the process returns to step **202**.

In summary, by pressing the teach/learn switch device **24** within a short predetermined period of time such as four seconds, the bridge device is linked to the transmitters that are normally used for moving movable barriers. The network transceiver **70** is linked to the network **12** via the antenna **72** by emitting or receiving a radio frequency signal **74** or by a wired interface **76** which may utilize an ethernet connection **76**.

Once all of the appropriate transmitters have been learned to the bridge device and the bridge device has been linked with the home network, the normal operation of the bridge may be implemented. Accordingly, referring now to FIG. **6**, it can be seen that a method of operation is designated generally by the numeral **300**. In this mode of operation the bridge device is required to receive power from the external power source at step **302**. And at step **304**, the controller **50** deactivates the teach function module **62** and turns on the RF transceiver and the network transceiver. Following this, at step **306**, the reset button press timer is initiated. At step **308** the methodology determines whether the learn/teach button **24** has been activated or not. If so, then the process is returned to step **200** at step **310** and the methodology described in FIG. **5** is implemented. If, however, at step **308** there is not a learn/teach button activation, then at step **312** the controller determines whether a radio frequency signal is being received or not. If a signal is not being received from the any of the transmitters **11**, then the process continues to step **314** to determine whether a network signal is being received via the transceiver **70**. If not, then the process is automatically returned to step **306**. If, however, at step **314** a signal **74** generated by the network **12** is received and the requested function is performed by the power outlet control **28**. Thus, it will be appreciated that the network world **12** may generate signals that are received by the bridge device to toggle on and off any appliance that is connected to the output control **28**. In this manner, added functionality is provided by the bridge device.

Returning now to step **312**, if the receiver detects the presence of a transmitter RF signal, then the process continues to step **320** and the received signal is analyzed to determine its particular code and is checked against stored codes in the non-volatile memory maintained by the controller **50**. At step **322** if it is determined that the code is invalid then the process is returned to step **306** and the timer is reinitiated. If, however, at step **322** it is determined that the received code is valid, then at step **324** the transmitter code is converted to a network code protocol or proper format and this signal is transmitted via the network transceiver **70** to the network world **12**. It will be appreciated that the transmitter codes are stored in the controller's memory and assigned a particular network code. As will be discussed in further detail, the master controller assigns specific functions to each network code and thus each transmitter button. The network transceiver then at step **326**, awaits a confirmation signal from the network, and if received the process returns to step **306**. If the confirmation signal is not received, then the network code signal is re-generated. It will be appreciated that if a confirmation signal is not received after a predetermined period of time, the process eventually returns to step **306**.

The normal mode of operation allows for the bridge to become active whenever a valid code is received through the built-in radio frequency receiver. In this mode, the bridge device is plugged into a permanent external power supply and the controller continuously monitors the RF receiver for signals. Whenever a valid signal is received, either, from the permanently affixed transmitter, a handheld transmitter, a vehicle mounted transmitter or a learning transmitter, then the bridge device converts this received transmitter code into a network code compatible with the home network protocol provided by the network world **12** and this signal is output via the network transceiver. In essence, the bridge device **10** is transparent to the user and simply functions as a "pipe" passing information through the system from one format to another. The user perceives the action of pressing a transmitter button with the reaction of a network function such as the opening of a door, turning lights on or off, the unlocking of a door, the activating or deactivating of an alarm system and the like.

From the foregoing it will be appreciated that the code generated by the bridge device in the first mode of operation is used to teach learning transmitters, such as a HomeLink™ device, and can be extended to teach multiple learning transmitters. Accordingly, with every press of the learn/teach switch, the bridge device **10** generates a unique code. By sending out a different code with every key or button actuation in this mode, the system **10** ensures that every learning transmitter learns a unique code. These unique codes may then be passed through the bridge device to the network during the normal mode of operation. Moreover, by transmitting unique codes, the master controller or network administrator, which may be implemented on a personal computer that coordinates the operations for the home network, may set up different functions for different transmitters. For example, a first transmitter may open a door and turn on the lights in the home while a second transmitter may be assigned to open a door and deactivate an alarm. The power outlet control **28** can be programmed to work directly from valid coded signals generated by non-network transmitters. In other words, the network may send signals directly to the bridge device so as to allow for switching on of an appliance or other powered device connected to the power outlet control. As such, the bridge device may also function to directly control an appliance on the network.

As noted previously, the network administrator may set up different functions for different transmitters with the use of a "master controller." By default, once a hand held transmitter or a HomeLink™ transceiver is programmed into the bridge device, the bridge device simply confirms the valid transmitter signal and re-transmits the signal using the home network protocol. In this case the signal always says "turn on all devices in my group." The group is assigned by the device identified as a "master controller." This device may be a hand held remote control with a small LCD display, such as a personal digital assistant or even a properly programmed cell phone. With this device a user can set multiple groups (a series of controllable devices such as lights) and scenes within the group (set all lights in group to 50% scene one; set half of the lights off and the other half to full on, scene 2, etc).

Referring now to FIG. **7**, it can be seen that a methodology for assigning particular functions to a transmitter is designated generally by the numeral **400**. Once a series of transmitters are programmed into the bridge, a user with a master controller incorporates the bridge device into a group by pressing the acquire button on the master controller at step **402**. The bridge device then "dumps" all the id codes of all the transmitters currently programmed into the bridge at step **404**. At step **406**, the master controller identifies all the network appliances associated with the bridge device, and, if available, any particular functionality associated with the appliance. For example, lights associated with the network

may have different lighting levels. In any event, the user may, at step **408**, re-configure the default "turn all on" command for each ID code stored and re-assign a different function. For example, a user may program two buttons from his HomeLink™ vehicle into the bridge. Then he acquires the button ID's from the bridge device into his master controller. At that point he may set one of his HomeLink™ buttons to "lock house" which will turn all lights off in the house, set the alarm system on, and close the garage door. The second button can then be assigned to "open house" which will open the garage door, turn on the lights in the garage, deactivate the burglar alarm, and unlock the front door. All of the manipulations are preformed by pressing menu buttons on the master controller. When the assignment step(s) are complete, the process is exited at step **410**. The bridge device will not have master controller functions, but it has the capability of transmitting the proper signal to the network once the master controller assigns new functions for each ID code.

Whenever a transmitter signal is received by the bridge device **10**, the power outlet may be energized thus turning on any appliance connected to the switch outlet. The network user may choose to provide a "scene" controlled to the power outlet thus assigning the function it will do with a specific transmitter code. In this embodiment, one transmitter may turn on the power outlet and another may turn the power on for five minutes, and yet another transmitter may do nothing at all. It will further be appreciated that the same functions can be performed backwards from the network world. In other words, since the network devices have access to the controller, the power outlet can be controlled to perform the specific functions.

Based upon the foregoing, the advantages of the invention over the known prior art are readily apparent. The bridge device contains all the circuit elements required to learn and teach transmitters to the bridge device and also for the bridge device to join a home network or any network connected to a plurality of appliances or electronic devices. The bridge device has a built-in, battery-operated transmitter which has the sole purpose of teaching a coded signal to a learning transmitter without the need for a third handheld transmitter. As such, HomeLink devices, which are primarily utilized for opening and closing garage doors, wherein the garage door operators are receptive to HomeLink signals, can also be employed to directly communicate with the bridge device. Yet another advantage of the present invention is that the bridge **10** can generate a multitude of unique coded signals so that a unique code can be taught to every transmitter joining the network. Additionally, the teaching of the learning transmitter to the bridge device enables the learning of standard transmitters such as those found in association with garage door openers, thus making the system compatible with more devices.

Still yet another advantage of the present invention is that bridge device is capable of recognizing a multitude of modes by monitoring the external power supply and the learn/teach button thus simplifying the user interface. Still yet another advantage of the present invention is that the bridge device is equipped with all the elements necessary to join a home network. Accordingly, it can convert signals received from non-network devices automatically without user intervention, thus, making the non-network devices act as if they were a part of the network. The bridge device is also advantageous in that it may be programmed out of the factory to respond to specific types of transmitter codes such as those found in garage door openers. The bridge may also be equipped to respond to specific types of coded network standards. Accordingly, the devices are adaptable for use with different types of home network standards as they are adopted by the industry. When the device is used with the proper transmitters and network codes, the interfacing conversion are automatically performed by the bridge device without the need to perform any additional acts, or interfacing programming functions by the user.

Thus, it can be seen that the objects of the invention have been satisfied by the structure and its method for use presented above. While in accordance with the Patent Statutes, only the best mode and preferred embodiment has been presented and described in detail, it is to be understood that the invention is not limited thereto or thereby. Accordingly, for an appreciation of the true scope and breadth of the invention, reference should be made to the following claims.

What is claimed is:

1. A bridge device linking at least one transmitter to a home network, comprising:

a transmitter signal receiver adapted to receive transmitter signals in a transmitter format from the at least one transmitter;

a network signal transceiver adapted to transmit and receive network signals in a network format to and from the network;

a bridge controller connected to said transmitter signal receiver and said network signal transceiver, said bridge controller converting said signals between said formats;

a power supply system connected to said bridge controller; and

a teach function module connected to said bridge controller, said teach function module disabled when said power supply receives power from an external power source.

2. The device according to claim **1**, further comprising:

an internal power source connected to said power supply system; and

said bridge controller implementing different modes depending upon said power supply system's source of power.

3. The device according to claim **2**, further comprising:

a learn/teach switch connected to said bridge controller, wherein actuation of said learn/teach switch when said teach function module is enabled causes said module to generate a code receivable by the at least one transmitter which is a learning transmitter which is adapted to receive and store said code.

4. The device according to claim **3**, wherein the learning transmitter is adapted to emit said code upon receipt of a predesignated stimulus, and said code is received by said transmitter signal receiver.

5. The device according to claim **4**, wherein said predesignated stimulus is one of a button actuation on the at least one learning transmitter, and entry of the at least one learning transmitter into a proximity range with respect to said transmitter signal receiver.

6. The device according to claim **2**, further comprising:

a teach function module connected to said bridge controller, wherein said teach function module is disabled, and said transmitter signal receiver and said network signal receiver are enabled when said power supply system is connected to said external power source.

7. The device according to claim **6**, further comprising:

a learn/teach switch connected to said bridge controller, wherein actuation of said learn/teach switch places said bridge controller in a transmitter learn mode, and wherein generation of said transmitter signal by the at

least one transmitter while said bridge controller is in said transmitter learn mode enables storing of said transmitter code contained within said transmitter signal in said controller.

8. The device according to claim **6**, further comprising:

a learn/teach switch connected to said bridge controller, wherein actuation of said learn/teach switch generates a join network signal by said network signal transceiver which is receivable by the home network.

9. The device according to claim **8**, wherein said join network signal is generated upon multiple actuations of said learn/teach switch in a predetermined period of time.

10. The device according to claim **6**, further comprises:

a learn/teach switch connected to said bridge controller, wherein a solitary actuation of said learn/teach switch places said bridge controller in a transmitter learn mode, which stores subsequently received transmitter signals in said controller, and wherein multiple actuations of said learn/teach switch places said bridge controller in a join network mode which enables communication between said controller and the home network.

11. The device according to claim **10**, wherein said network transceiver is linked to the home network and facilitates association of the transmitters with appliances connected to the home network.

12. The device according to claim **1**, further comprising:

a master controller in communication with said bridge controller, said master controller linking specific transmitter signals to specific network signals.

13. A method for enabling a home network bridge device, comprising:

providing a controller linked to a transmitter signal receiver, a network signal transceiver, and a power supply system;

detecting a type of power source connected to said power supply system;

selectively enabling a teach function module connected to said controller depending upon said type of power source detected; and

disabling said teach function module if an external power source is detected by said controller.

14. The method according to claim **13**, further comprising:

actuating a learn/teach switch which is connected to said controller and which enables said transmitter signal receiver;

receiving a transmitter signal generated by at least one type of transmitter, said transmitter signal containing a code associated with the at least one transmitter; and

storing said code in said controller.

15. The method according to claim **13**, further comprising:

actuating a learn/teach switch which is connected to said controller and which enables said network signal transceiver; and

generating a network join signal that is formatted to be received by a home network.

16. The method according to claim **13**, further comprising:

actuating a learn/teach switch which is connected to said controller;

determining a number of actuations of said learn/teach switch in a predetermined period of time;

enabling said transmitter signal receiver if only a single actuation of said learn/teach switch in said predetermined period of time so as to enter a transmitter learn mode;

enabling said network signal transceiver if more than one actuation of said learn/teach switch in said predetermined period of time is detected so as to enter a network join mode;

receiving transmitter signals if in said transmitter learn mode and storing a code contained within said transmitter signal; and

generating a network join signal by said network signal transceiver if in said network join mode.

17. The method according to claim **16**, further comprising:

entering a normal mode of operation after said network join mode and said transmitter learn mode have lapsed;

receiving said code in said transmitter signal receiver;

transferring said code to said controller;

converting said code into a network signal; and

emitting said network signal via said network signal transceiver.

18. The method according to claim **17**, further comprising:

enabling said network signal to control operation of at least one appliance.

19. The method according to claim **17**, further comprising:

assigning a unique code to each said transmitter signal learned by said controller; and

converting each said unique code into a unique network signal controlling operation of at least one appliance with said unique network signal.

20. The method according to claim **17**, further comprising:

providing a power outlet control connected to said controller; and

enabling said network signal to control operation of said power outlet control.

21. The method according to claim **17**, further comprising:

providing a power outlet control connected to said controller; and

enabling said transmitter signal to control operation of said power outlet control.

22. The method according to claim **13**, further comprising:

actuating a learn/teach switch that is connected to said controller; and

enabling said network signal transceiver to enter a network join mode if more than one actuation of said learn/teach switch in said predetermined period of time is detected so as to enable the network bridge to join a network.

23. A method for enabling a home network bridge device, comprising:

providing a controller linked to a transmitter signal receiver, a network signal transceiver, and a power supply system;

detecting a type of power source connected to said power supply system; selectively enabling a teach function module connected to said controller depending upon said type of power source detected;

enabling said teach function module if an internal power source is detected by said controller;

activating a learn state for a transmitter to be associated with the bridge device;

actuating a learn/teach switch connected to said controller while said transmitter learn state is active;

generating a code by said teach function module; and

receiving and storing said code in the transmitter.

24. A method for operating appliances connected to a home network system, comprising:

providing a bridge controller linked to a transmitter signal receiver and a network signal transceiver;

receiving a transmitter signal in a transmitter format, said transmitter signal sent from a non-network transmitter;

converting said transmitter signal into a network signal in a network mode format;

emitting said network signal from said network signal transceiver for receipt

by the home network system which controls operation of at least one appliance;

linking a master controller to said bridge controller;

dumping at least one button ID code associated with said non-network transmitter to said master controller;

identifying at least two functions maintained by said at least one appliance; and

reassigning said at least one button ID code identified at said dumping step with one of said at least two functions identified at said identifying step.

25. The method according to claim **24**, further comprising:

learning said transmitter signal to said bridge controller; and

learning said network signal transceiver to the home network, wherein said learning steps occur prior to said converting step.

26. The method according to claim **25**, further comprising:

switching a power outlet control between on and off states upon receipt of said transmitter signal.

27. The method according to claim **25**, further comprising:

switching a power outlet control between on and off states upon receipt of

a network command signal received by said network signal transceiver.

28. The method according to claim **24**, further comprising:

learning said transmitter signal to said bridge controller; and

learning said network signal transceiver to the home network, wherein said converting step occurs prior to said learning steps.

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